REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application.

Disposition of the Claims

Claims 2-23, 25-38, 40, 42-43, and 45-46 are pending in this application. Claims 45, 46, are independent. The remaining claims depend, directly or indirectly, from claims 45, and 46.

Claim Amendments

Claims 45 and 46 have been amended in this reply to clarify the present invention recited. Specifically, the limitations of claim 10 have been included into claims 45 and 46. Claims 47 and 48 have been cancelled without prejudice or disclaimer. No new matter has been added by way of these amendments, as support may be found in, for example, original claim 10.

Rejections under 35 U.S.C. § 102

Claims 2-7, 40, 42, 43, and 45-48 are rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. patent No. 6,412,577, issued to Chen ("Chen"). Claims 45 and 46 have been amended to recite the limitations of claim 10, rendering the rejection moot with respect to those claims. Claims 47 and 48 have been cancelled, rendering the rejection moot with respect to those claims. Accordingly, withdrawal of the 102 rejection of the present claims is respectfully requested.

Rejections under 35 U.S.C. § 103

A. Claims 2-7 and 45-48 are rejected under 35 U.S.C. § 103(a) as being unpatentable over "The Operational Mechanics of The Rock Bit," by Ma, *et al.* ("the Ma book"). Claims 45-46 have been amended in this reply to include the limitations of claim 10, rendering the rejection moot. Claims 47 and 48 have been cancelled, rendering the rejection moot with respect to these claims as well. Accordingly, withdrawal of the §103 rejection based on Ma is respectfully requested.

B. Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma in view of "Drag-Bit Performance Modeling," by Warren, *et al.* ("Warren"). Claims 8 and 9 depend, directly or indirectly, from independent claim 45. Claim 45 has been amended in this reply to include the limitations of claim 10, rendering this rejection moot. Withdrawal of this rejection is respectfully requested.

C. Claims 10-23 and 25-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma, Warren, and U.S. Patent No. 6,695,073, issued to Glass, *et al.* ("the '073 patent"). Claims 10-23 depend, directly or indirectly, from independent claim 45. Claims 25-35 depend, directly or indirectly, from independent claim 46. Claims 45 and 46 have been amended in this reply. To the extent that this rejection may apply to the amended claims, the rejection is respectfully traversed.

As amended, claims 45 and 46 recite the limitations of claim 10, namely that evaluating comprises summing magnitudes of the radial forces with respect to a direction to generate a sum of the radial forces; comparing the sum of the radial forces to an applied weight-on-bit; and generating a ratio between the sum of the radial forces and the applied weight-on-bit.

Advantageously, the present inventors have discovered that by designing a bit such by comparing the ratio of the radial force on the bit and the applied weight on bit, that an improved bit / drilling sting may be achieved.

Dependent claims recite a ratio of 0.20, *i.e.*, the resultant radial force is less than or equal to twenty percent of the applied weight on bit. In other words, at any given time during drilling the resultant radial force should not exceed 20% of the WOB. One skilled in the art will appreciate that bit performance may be improved as a ratio of the resultant radial force to an applied weight-on-bit is minimized. Thus, in an embodiment of the present invention the resultant radial force is less than or equal to 10% of the WOB, and more preferably, the resultant radial force is less than or equal to 5% of the WOB.

Figure 5 shows a chart plot of a distribution of ratios of resultant radial force to an applied weight on bit. The chart plot enumerates the occurrences of a ratio of the resultant radial force to the applied weight-on-bit. The frequency of occurrences in the present chart plot is presented on the Y-axis as percentages of total drilling time. The ratios between the resultant radial force and the applied weight-on bit are presented on the X-axis in decimal form, *i.e.*, fractions of the radial force to the applied weight-on-bit.

In contrast, the '073 patent (Glass) relates to a method for designing a bit that involves balancing the *torques* acting on cutters while a bit is drilling through a transitional section between soft and hard rock formations. Specifically, the '073 patent discloses optimizing a fixed-cutter drill bit so that cutter torques are evenly distributed not only during drilling of homogeneous rock, but also in transitional formations. *'073 patent, abstract.*

The Applicant respectfully notes that torque (τ) is a vector that measures the tendency of a force to rotate an object about some axis. The magnitude of a torque is defined as force times the length of the lever arm radius. Just as a force is a push or a pull, a torque can be thought of as a twist. The entire disclosure of the '073 patent is concerned with addressing the concern of torque, and not radial force considerations, as in the present claims.

As its preferred embodiment, the '073 patent discloses using an Amoco model[1] to simulate down-hole conditions while simulating drilling through a transition zone of differing compressive strengths. The data is then plotted graphically to visually see the representation of % Torque per Cutter distribution under the specified drilling conditions. As an example, Figure 3A from the '073 patent is provided below.

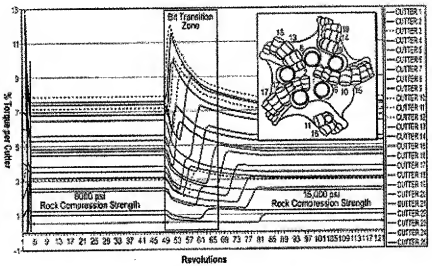

FIG. 3A

The '073 patent goes on to state that the graphical representation indicates the area susceptible to impact by visually displaying the zone with the highest % Torque per Cutter.

In the disclosed design method, the bit design is then manipulated (by changing features such as bit profile, cutter size, blade position, cutter positioning and/or cutter redundancy) to minimize the effect of the % Torque per Cutter distribution and optimize bit performance for drilling the transition zones.

In short, the '073 patent is directed to using outputs from the Amoco program to generate torque per cutter distribution graphs, and using those graphs to reduce local maximums in torque on cutter for transitional regions.

Moreover, paragraph 16, lines 1-3 of the '073 patent state that the present invention teaches that the forces which appear on the individual cutting elements of a drill bit should be evenly distributed, as far as possible, under transitional conditions as well as under steady-state conditions. Thus when the drill bit drills into a layer of harder or softer rock, the chances of an individual cutter receiving a disproportionate load, and possibly breaking are greatly reduced.

Thus, to the extent that the '073 patent relates to *forces*, as claimed, as compared to *torque* manipulation, the '073 patent merely discloses balancing all forces, and does *not* show or suggest manipulating a bit design to achieve a desired ratio of radial *force* to applied weight on bit. Moreover, in certain embodiments, the present invention specifically relates to creating an *unbalanced* situation.

As indicated in the present specification, a drill bit may be purposefully designed to produce a radially imbalanced bit, such as in a particular direction, for example, to obtain a design for a bit having a particular "walking" tendency. Examples of bit design parameters that

[1] When referring to the "Amoco Model," the '073 patent is referring to the Amoco drag bit force balance program

may be adjusted include, but are not limited to, an arrangement of cutting element on a drill bit (which may be within a row or between rows), a number of cutting elements on a drill bit, a geometry of cutting elements on a drill bit, or orientation of cutting elements.

Ma relates to the kinematics of a roller cone bit, but does show or suggest evaluating a bit on the basis of a ratio of radial force to applied weight on bit. In fact, while Ma discloses various force determinations, Ma does not specifically disclose or suggest evaluating a bit structure on the basis of radial force, much less on the basis of a ratio of radial force to applied weight on bit. Warren suffers from a similar deficiency, in that it also fails to show or suggest evaluating a bit on the basis of a ratio of radial force to applied weight on bit.

Applicant asserts that the Examiner's conclusion of obviousness is based on improper hindsight reconstruction. *See* MPEP § 2143; *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132 (Fed. Cir. 1985) (stating that "[t]he invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time"); *In re Fritch*, 972 F.2d 1260 (Fed. Cir. 1992) (stating that "it is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious . . . . This court has previously stated that 'one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.'"); *In re Wesslau*, 353 F.2d 238 (C.C.P.A. 1965) (stating that "it is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art"). The Applicant respectfully asserts that the Examiner is relying on the Applicant's

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described in "Drag Bit Performance Modeling", Society of Petroleum Engineers #15618 1986.

specification to provide the source of the "inspiration" to combine the prior art references in the manner suggested. Support for this assertion is found in the closing paragraph of the Examiner's rejection, which simply states that Glass "disclos[es] programmed calculations of summed orthogonal cutter forces inclusive on weight-on-bit." *Office Action, page 12.*

Significantly, the Examiner has not pointed to a single location in any of the three combined prior art references which show or suggest the present limitation of determining a ratio of *radial* force to *applied* weight on bit, to evaluate bit performance.

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 05516/148002).

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Respectfully submitted,

By _____

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Attachments